



# **ELECTRONIC AUDIO EXPERIMENTS**

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***Technical Document***

***Longsword V4 Manual***

***Version 2***

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***John Snyder***

## **INTRODUCTION**

Thank you for your purchase of the Electronic Audio Experiments **Longsword!** This manual is an in-depth guide for properly using and enjoying your pedal.

But first, a little bit on the origins of the Longsword. This was the first EAE pedal, conceived in the margins of my grad school notebook and designed during Boston's "snowpocalypse" in early 2015. At the time I lived in a basement apartment, and would spend long nights breadboarding while the snow (literally) buried us in. The Longsword was designed to meet a specific gap in my guitar rig at the time. As it turned out, my needs were not as unique as I thought! The end result was a solid, general purpose distortion pedal.

When playing distorted guitar in a band setting, my preferred style is to set a single channel amplifier on the verge of breakup and push it a bit harder with a mix of pure clean gain and some saturation inherent to whatever pedal(s) I'm using. Thanks to its EQ, adjustable clipping/compression settings, and high output volume on tap, the Longsword is well suited to this purpose and many others.

At its core, the Longsword is an op-amp drive with diode shunt clipping. An integrated circuit called an operational amplifier (aka op amp) increases the signal amplitude (loudness), and a pair of diodes limits the peaks. Cutting the peaks off of a signal generates a spectrum of new harmonics, producing the distorted tones we all know and love. This circuit block is found in hundreds of pedals (*including the Distortion+, Rat, OCD, even the venerable Klon Centaur/KTR*) and is, in itself, not special.

The Longsword is made special because of the way its clipping amplifier is placed between a series of other amplifiers and filters to precisely shape the sound. Many op-amp-centric overdrive pedals sound good with one particular kind of guitar or amp, or they have only one sound that they do well. Oftentimes, ones that sound good on their own can drop out of the mix in a band setting. By taking advantage of the Longsword's dynamic range and powerful equalization, the player may easily defeat these shortcomings.

Thanks for reading!

-John Snyder, EAE

## **OPERATION**

The Longsword requires an industry standard 9VDC center-negative supply with a 2.1mm barrel connection. We recommend (e.g. Truetone™, Voodoo Labs™, Strymon™, Cioks™, etc). The Longsword draws 75mA of current when engaged.

The Longsword, as of Version 4.5, has a power supply protection circuit which shuts down the pedal in the event of reverse polarity or a DC voltage greater than 9V. The Longsword does not and cannot use batteries.

The Longsword uses soft-touch relay switching in a true bypass configuration. The relay will default to the bypass state in the event of power loss.

Here's my recommended procedure for dialing in the Longsword for the first time:

1. Begin with your amplifier set to its optimal clean tone.
2. Then, set all of the EQ controls on the Longsword to **noon**, set the **drive** and **level** at **minimum**, ensure the boost is **off**, and set all toggle switches **up**.
3. Turn on the pedal and slowly increase the **drive** and **level** until they are to your liking. You'll notice that the **drive** control introduces a natural high-end rolloff as it is increased, reducing harsh upper harmonics. You'll also notice lots of volume on tap!

Next, it's time to adjust the tone controls. With everything at noon, the Longsword has a mostly flat response for guitar frequencies. The tone controls are more like a studio EQ than a traditional stompbox control. The bands are fairly non-interacting, and small changes can have a drastic effect. Thus we recommend adjusting the knobs gradually, with small boosts and cuts away from noon. The **low** and **high** controls form a James-Baxandall arrangement. This is a pair of passive shelving filters that cut frequencies below or above a central crossover point. The **mid** control is a single band boost/cut with a selectable center frequency using the **SHIFT switch**. Up on the toggle corresponds to 1kHz (hi midrange), and down corresponds to 300Hz (low midrange).

### **Some notes on the EQ:**

- If you boost both the **low** and **high**, you can get an effective mid scoop, and conversely you can cut both to get an effective mid boost.
- The Longsword has a great deal of low end available, so a tighter tone can be achieved by cutting the bass, particularly with an already overdriven amplifier.
- Don't be afraid to scoop the low midrange (set the **FREQ switch** up), as it may be a source of muddy tone with some guitars, especially on the neck pickup!

The **DIODE toggle switch** will affect the dynamic response of the pedal, with settings as follows:

- Switch **up** is medium compression via MOSFETs, which have high headroom and a smooth transition into clipping which becomes fairly aggressive at higher gain settings.
- Switch **center** removes diode compression altogether, which lets the natural clipping of the op-amps shine through. This mode is recommended if you want high dynamic range or are using the pedal as a clean boost/EQ into an already driven amp.
- Switch **down** is high compression, using silicon diodes.

The differences between clipping modes are most apparent if you gradually turn up the gain control to find the threshold of clipping. This will vary depending on the strength of the input source (i.e. how hot your pickups are). We encourage experimentation!

Finally, the **Boost Footswitch** corresponds to the Longsword's **Boost** knob. The boost is placed before the main distortion circuit and has up to +20dB of gain and a low frequency cut at 300Hz. This moderate low cut is ideal for tightening up the Longsword at higher gain settings, as well as providing two distinct voicings for low and high gain.

### **In conclusion...**

The Longsword is a very versatile distortion / overdrive pedal with a plethora of options on hand and we hope it helps you dial in the exact tone you're looking for, regardless if you're playing indie rock or doom metal. Thanks again!

### **CHANGELOG**

Version 2	Manual release for Longsword V4.5
Version 1	Manual release for Longsword V4



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